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A comparative spatial analysis of majoritarian and proportional elections

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Abstract

This study estimates spatial representations of recent elections in Canada, France, The Netherlands and Israel. Its purpose is to test whether there exist systematic differences in the extent of spatial dispersion among parties and candidates in the majoritarian and proportional electoral systems. Canada and France are majoritarian systems, while The Netherlands and Israel are highly proportional. The study uses a measure of central tendency developed by Kollman et al. (1992, 1993, 1998) [Kollman, K., Miller, J.H., Page, S.E., 1992. Adaptive parties in spatial elections. American Political Science Review, 86, 929–937; 1993. Adaptive parties and spatial voting theory. In: Grofman, B. (Ed.), Information, Participation & Choice. University of Michigan Press, Ann Arbor, pp. 161–173; 1998. Political parties and electoral landscapes. British Journal of Political Science, 28, 139–158] and non-parametric statistical tests to compare the relative dispersion of parties and candidates across the maps. The analysis reveals that parties and candidates in the majoritarian systems are located significantly closer to the center of the distribution of voters than those in proportional systems. The estimated spatial maps also provide information useful for interpreting the bases of electoral politics in each country.

Keywords: Electoral systems; Spatial theory of voting

1. Introduction

Positive theories of the effects of electoral systems on the position-taking incentives faced by candidates and political parties have largely emerged only in the last decade. Studies by Cox (1987, 1990, 1991, 1997) initiated the contemporary literature. These studies use the spatial theory of voting to determine whether a given

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electoral system induces convergent or non-convergent electoral incentives. By clarifying the spatial incentives provided to candidates and parties, this research provides insight central to understanding the organization of party systems (Katz, 1980), the dynamics of government formation (Laver and Schofield, 1990) and the characteristics of policy representation (Huber and Powell Jr, 1994). However, a corresponding body of empirical research has lagged behind these theoretical advances. Only a handful of studies empirically evaluate the relationship between electoral rules and spatial incentives.

This study provides a spatial analysis of recent elections in Canada, France, Israel and The Netherlands. It contributes to the empirical spatial theory debate on electoral systems and spatial strategies by empirically testing whether majoritarian and proportional systems produce systematic differences in party and candidate locations. Metric multidimensional scaling is used to estimate the spatial positions of parties and voters in the 1993 Canadian federal election, the 1994 Dutch parliamentary election, the 1988 French presidential and general elections and the 1992 Israeli Knesset election. These countries differ in majoritarian and proportional characteristics but share other important similarities. Canada, The Netherlands, and Israel are parliamentary systems, while France combines presidentialism with a parliamentary assembly. All are multiparty systems with at least five parties securing legislative representation in each country's most recent national election. Canada is majoritarian with high electoral thresholds and consistent single party control of parliament.[1] The Dutch and Israeli systems are highly proportional, with effective thresholds below 5% and with a coalition government as the norm. France presents an intermediate case, but scholars typically describe the Fifth Republic in majoritarian terms (Lijphart 1984, 1994; Taagepera and Shugart, 1989; Shugart and Carey, 1992). Table 1 reports

Table 1
Electoral formula, district magnitude and effective number of parties[a]

Country	Canada (1993 general election)	France (1988 presidential election)	The Netherlands (1994 parliamentary election)	Israel (1992 Knesset election)
Formula	Simple plurality	Majority-runoff	PR-d'Hondt with <1% threshold	PR-d'Hondt with 1.5% threshold
District magnitude	1	1	150	120
ENP votes	3.92	4.26/3.27	5.71	4.93
ENP seats	2.35	3.00/2.31[b]	5.42	4.40

[a] Data sources: Canada, LeDuc (1994); France, Goldey and Johnson (1988); Israel, Arian and Shamir (1995); The Netherlands, Anker and Oppenhuis (1994).

[b] The first figure is the effective number of parties as calculated from the first round National Assembly vote receipts. The second figure is the effective number of parties as calculated from the second round National Assembly vote receipts.

[1] Canada's multiparty system is attributed to the strength of regional parties, especially the Bloc Québécois and the western Reform Party.

the salient electoral system features, including electoral formula, district magnitude and the effective number of electoral and parliamentary parties for each country.

The data used to estimate the spatial maps are obtained from the 1993 Canadian Election Study (Johnston et al., 1993) the 1992 Israeli Election Study (Asher and Shamir, 1992a,b), the 1994 Dutch Parliamentary Election Study (Anker and Oppenhuis, 1994) and the 1988 French National Election Study (Pierce, 1988). The estimated maps locate parties and voters in the same space. Then a measure of spatial dispersion developed by Kollman et al. (1992, 1993, 1998) is used to calculate the extent to which parties and candidates are concentrated near the center of the political space or dispersed towards the periphery of the space. The Kollman et al. centrality measure permits comparison of the party and candidate dispersion across maps. To foreshadow, the maps reveal that parties in the majoritarian systems are located significantly closer to the center of the distribution of voters than those in proportional systems.

2. Theoretical expectations and empirical evidence

The conventional expectation is that majoritarian systems induce convergent spatial incentives and that proportional systems induce divergent spatial incentives. The rationale is intuitive. Majoritarian systems support fewer parties (Taagepera and Shugart, 1989; Lijphart 1984, 1994), and are designed to confer government control on a single party. Because there exists little possibility of a coalition government, political parties must maximize vote share and win the election to implement desired policies. With few parties, vote maximizing locations are typically near the center of the electoral space. Conversely, proportional systems support more parties, and through the mechanics of proportional representation parties can influence government policy with relatively small vote shares. A greater number of political parties also limits the spatial mobility of parties and produces vote maximizing positions for some parties away from the center of the space. The combined effect of these incentives is to induce some candidates or parties to locate closer to the periphery of the electoral space.

Theoretical studies present more complex analyses and are divided according to whether the electoral system is considered in isolation or in conjunction with the politics of government formation. Cox (1987, 1990, 1997) studies the relationship between electoral systems and spatial incentives. Cox argues that of the four major electoral system variables — formula, district magnitude, ballot structure and, while not strictly exogenous, the effective number of parties — district magnitude has the largest influence on spatial incentives. Systems characterized by low district magnitude — the number of seats in each district — induce convergent spatial incentives, while systems characterized by high district magnitude induce divergent spatial incentives. Surprisingly, electoral formula — the arithmetic rule that translates votes to seats — has little independent impact on spatial incentives (Cox, 1991). In practice, however, electoral formula and district magnitude are closely linked (Lijphart, 1994, Tables 2.1 and 2.2). Proportional formulas, by definition, operate on multi-

member districts. Majoritarian formulas often operate in conjunction with single-member districts, although there are important exceptions.[2]

For proportional systems, Schofield (Schofield, 1993, 1995, 1997a, 1997b; Schofield et al., 1998; also see Laver, 1997) considers the case where parties consider the politics both of elections and government formation. Schofield's (1993) key result is that to facilitate post-election coalition bargaining some parties may pursue relatively moderate electoral strategies to increase the likelihood of influencing the composition and policies of the post-election government. Optimal spatial location depends on the marginal trade-off between winning an additional seat and the likelihood of being included in the governing coalition. Parties bound by credible commitments to declared policy positions will seek to maximize the expected value of a lottery over parliamentary seats and the policies enacted by potential coalition governments. The resulting spatial incentives are typically more moderate than suggested by models that only consider electoral incentives.[3]

The political implications of these incentives are well documented. Majoritarian electoral systems provide clear political choices, but do not represent the preferences of heterogeneous polities very well. Proportional systems represent diverse policy preferences well, although at the cost of government identifiability and responsibility (Klingeman et al., 1994; Huber and Powell Jr, 1994; Cox, 1997). Lijphart (1984), Shugart and Carey (1992) and Cox (1997) also note the potential trade-off between representation and government stability. Coalition governments in highly representative systems may have shorter duration than governments in majoritarian systems (but see Schofield, 1993).

The relatively few empirical studies in this literature provide little basis for generalizing about the position taking incentives across political systems.[4] Among comparative studies, Lin et al. (1996) find Taiwanese political leaders immediately prior to the 1992 Legislative Yuan election relatively dispersed in a two-dimensional space with underlying axes reflecting ethnic identity and economic distributional issues, respectively. Myagkov and Ordeshook (1998) recover party and candidate positions in the 1995 Russian Duma election and 1996 Russian presidential election, dispersed in a two-dimensional space in which the primary axis reflects attitudes towards political and economic reform explains most of the spatial variation. Among studies that specifically consider the effects of the electoral system on spatial incentives, Dow (1998) finds parties in Chilean Senate elections conducted under the d'Hondt pro-

[2] Majoritarian systems may use either single- or multi-member districts. The familiar US and UK cases use single-member district plurality systems. Examples of majoritarian formulas operating on multi-member districts include the former Japanese Diet electoral system, which used the single non-transferable vote (SNTV) system applied to multi-member districts. For a discussion, see Lijphart (1994, pp. 16–25).

[3] Lin et al. (1998) demonstrate that multiparty elections can produce convergent equilibria if parties maximize vote share and voters are sufficiently uncertain of party and candidate positions. This result, however, is sensitive to both the specification of voter utility functions and the spatial distribution of voters.

[4] For the purposes of literature review, I limit the definition of empirical spatial theory to those studies that estimate spatial representations of elections. This excludes studies that incorporate measures of policy or ideological distance as explanatory variables. The latter analyses are routine.

portional representation rule clustered at the outer quartiles of the distribution of voters. In several recent studies, Schofield and Washington University colleagues present spatial analyses of Israeli, Dutch and German (Nixon et al., 1995; Schofield et al., 1998), Israeli (Ofek et al., 1998), Italian (Giannetti et al., 1999) and several other Western European elections (Schofield, 1997b). These studies typically report estimated party locations dispersed across the electoral space, with some parties in highly proportional countries such as Italy (pre 1993 electoral reforms: compare Schofield et al., 1998; Giannetti et al., 1999) and The Netherlands located near the center of the electoral space. Interestingly, Schofield (1997b) reports that in the late 1970s Great Britain — the archetypal Westminster system — neither the Labour Party nor the Conservative Party were located near the center of the space. Finally, studies of the highly majoritarian United States have produced anomalous or at least inconclusive findings. For example, Rabinowitz (1977) and Poole and Rosenthal (1984) estimate the locations of United States presidential candidates near the periphery of the distribution of voters. In contrast, Enelow and Hinich (1984) and Enelow (1988) recover candidates and parties near the center of the electorate.

3. Statistical methodology

To estimate the spatial maps I use a metric multidimensional scaling method developed by Cahoon and Hinich (Cahoon et al., 1978; Enelow and Hinich, 1984, Appendix 1; Hinich and Ghobarah, 1999). The maps locate party and voter positions for each election in a two-dimensional space. I estimate two-dimensional maps because it is doubtful that a single axis adequately represents electoral competition in any of these countries. Schofield et al. (1998) argue that two dimensions best represent Dutch electoral competition. Similarly, Nixon et al. (n.d.) find a two-dimensional solution is best for the 1992 Israeli Knesset election. More generally, Lijphart (1984) finds the single dimension assumption justified in only three postwar democracies (Ireland, New Zealand, United States). My estimates confirm that one-dimensional maps generally fare poorly compared with two-dimensional scalings.

Briefly, the methodology assumes the *j*th voter's evaluation score for party *y*. $T_j(y)$ is a function of the spatial distance between the respondent and the party. Party and candidate evaluation scores are available in recent national election studies conducted in each country.[5] In standard notation:

$$T_j(y)=\beta\sum_{i=1}^{n}\sqrt{(x_{ji}-y_i)^2}+\varepsilon_{iy} \tag{1}$$

where $\beta<0$, i indexes the number of dimensions or issues of the election, x_{ji} is the ideal point of voter j on dimension i and y_i is the location of party y on the same

[5] Cahoon et al. (1978), Enelow and Hinich (1984, Appendix 1) and Hinich and Ghobarah (1999), Enelow and Hinich (1984) and Hinich and Ghobarah (1999) provide details about the statistical methodology.

axis. The error term, ε_{iy} captures unmeasurable, non-systematic influence on $T_j(y)$, which are normally distributed with zero mean and is independent across voters and parties. The methodology calculates a maximum likelihood factor analysis of an adjusted version of the sample covariance matrix of the $T_j(y)$ scores to estimate the party and candidate positions on the defined axes. The methodology then estimates voter positions using a least squares regression that includes the estimated party locations as independent variables. The origin of the space is the mean voter ideal position on each axis. The use of evaluation scores differs from previous studies that use party elite surveys or analyses of party manifestos to obtain spatial representations of party locations. Schofield and co-authors use issue proximity data to estimate spatial representations.

4. Empirical results

4.1. The spatial maps

Figs. 1–4 present the estimated spatial maps. Each map places the estimated party positions on the density of voter ideal points. Also, the estimated locations of party leaders and major political figures are presented. These provide a check that the

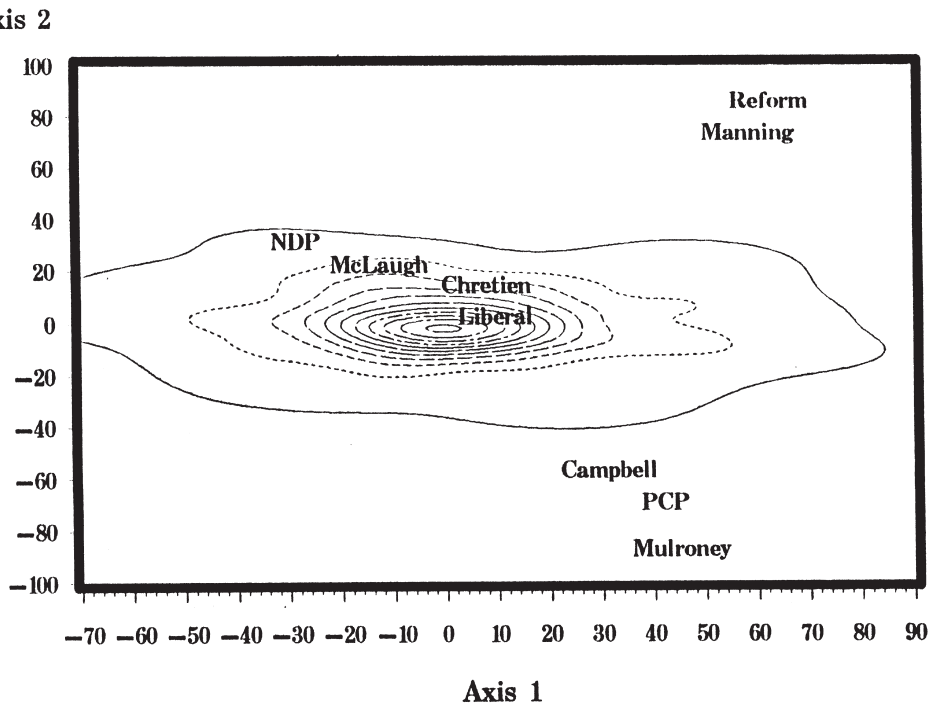

Fig. 1. Party locations and voter density, Canadian federal election, 1993.

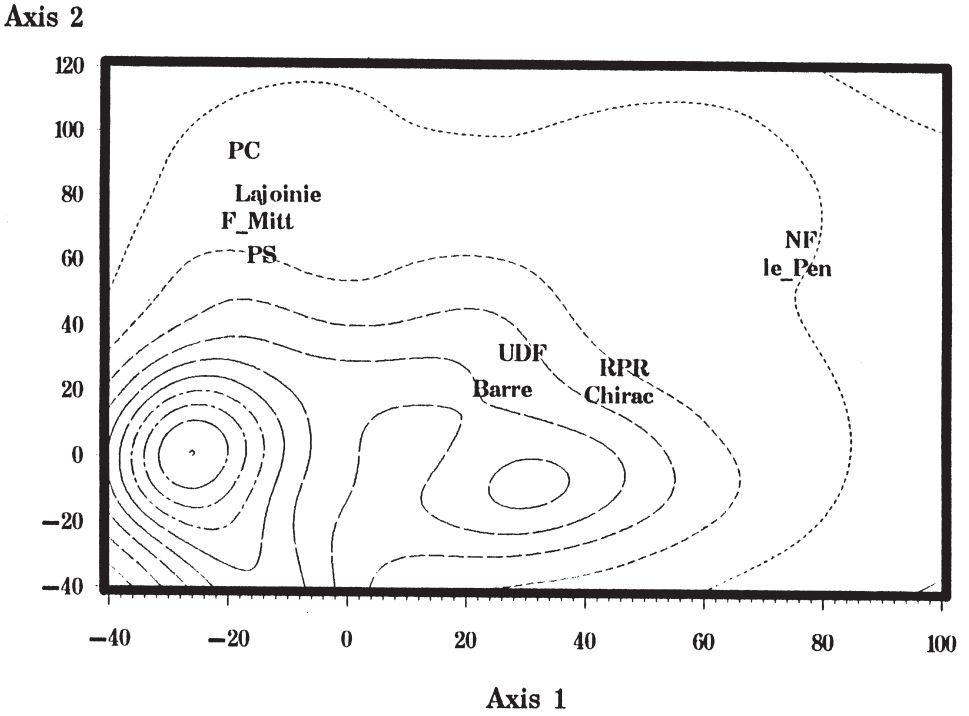

Fig. 2. Party locations and voter density, France, 1988.

maps scale correctly, as one expects these figures to scale close to their associated parties. The voter density is estimated using a non-parametric Gaussian kernal and spline interpolation (Scott, 1992).

Simple visual inspection of the maps reveals both similarities and noticeable differences across countries. In all cases the left to right order of parties appears correct. The Canadian space ranges from the New Democratic Party on the left to the western Reform Party on the right.[6] The French political space is bounded on the left by the Communist Party and on the right by Jean-Marie le Pen's National Front. Likud and Labor anchor the Israeli space, with most voters scaling between the two parties. In The Netherlands, the PvDA (Labor) scales to the far left, while the conservative VVD (People's Party for Freedom and Democracy) is on the right. The map attests to the stability of the Dutch political system as it is very similar to that estimated by Schofield et al. (1998) using both a different methodology and data from the late 1970s. In each country, political leaders scale close to their respective parties. Frits

[6] The Canadian map does not estimate the location of Bloc Québécois because the Canadian Election Study, 1993, does not solicit evaluation scores for this party outside of Québec. Nor does the Canadian Election Study, 1993, solicit evaluation scores for the Reform Party in Québec. Consequently, the spatial map is estimated for Anglophone Canada only.

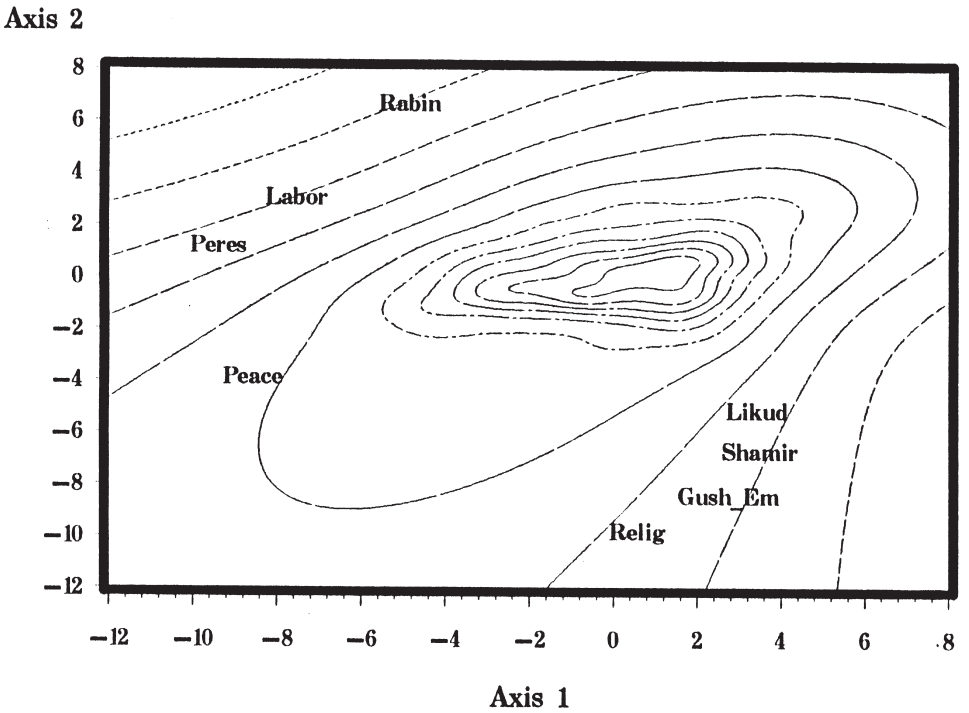

Fig. 3. Party locations and voter density, Israeli Knesset election, 1992.

Bolkestein, for example, is the VVD leader and first candidate on the party list. On the Israeli map, Yitzhak Shamir is adjacent to Likud, while the two Labor leaders, the late Yitzhak Rabin and Shimon Peres, flank that party. The maps recover comparable leadership — party proximity in the Canadian and French elections. In all the maps, at least some parties scale away from the central part of the electorate. In the Dutch and Israeli elections, no party is near the origin.

Although it is not the purpose of this study to provide detailed analyses of the recovered electoral spaces, several cases present clear interpretations. The Israeli map, for example, presents a clear left–right horizontal axis corresponding to national security, the territories and the peace process. The vertical axis reflects the Israeli secular–nonsecular cleavage. The Dutch map may be interpreted analogously, with the major axis corresponding to a general left–right and the vertical axis reflecting a secular–nonsecular split. The French map presents a major left–right dimension on the horizontal axis. The vertical axis is more difficult to interpret, but likely corresponds to issues centering on trade, European Union and similar considerations. The Canadian horizontal axis again captures a general left–right orientation. The vertical axis likely reflects a populist–elitist dimension, with the Reform Party scaling to the top of this axis and the Progressive Conservative Party scaling near the bottom of the axis.

The Canadian map provides the strongest visual evidence of centralizing behavior.

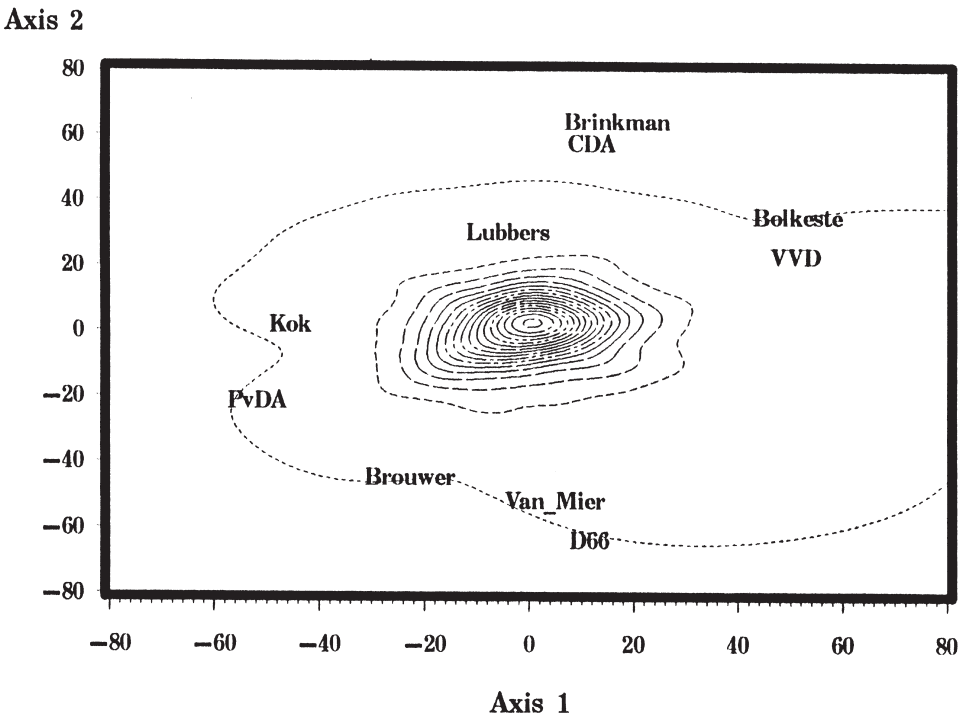

Fig. 4. Party locations and voter density, Dutch parliamentary election, 1994.

The Liberal Party is adjacent to the origin, as one would expect given the party's 41% vote share. The Progressive Conservative and New Democratic Parties are about equidistant from the Liberal Party, with the regionally based Reform Party well away from the center of the national electoral sample. Despite the Liberal Party's drubbing at the polls, it is surprising to see the Conservatives so far from the center of the space. This may indicate the existence of a non-spatial issue such as "competence" that influences the estimated position of this party.[7]

The French map recovers a bimodal distribution of voters. The major node is left and below the origin; the minor node is right of the origin near the Gaulist UDF and RPR parties. Francois Mitterrand and the Socialist Party scale closest to the major node. This is as one would expect given Mitterrand's victory in the 1988 presidential election and the Socialist Party's capture of 48% of the legislative seats in the subsequent Assembly election. The National Front and right-wing nationalist, Jean-Marie le Pen, scale well to the right of the RPR and UDF, but sufficiently close

[7] Issues such as honesty, integrity and competence are non-spatial or "valence" issues in the sense that one assumes voters have identical preferences on these dimensions. Specifically, more of these attributes are presumably preferred to less. These differ from policy issues such as military spending, scope of government and similar considerations over which voter preferences differ. For a discussion, see Stokes (1992).

to enough voters to account for his 14.6% first ballot share in the presidential election.

The Dutch and the Israeli maps provide little evidence that parties pursue centripetal electoral strategies. This is especially true in The Netherlands where parties scale to the periphery of the distribution of voters. The PvDA, which won the largest share of parliamentary seats, is only marginally closer to the center of the voter distribution than the right VVD. The Christian Democratic Party (CDA), consisting of both Catholic and Protestant groups, scales to the top of the vertical axis, while, the socially liberal Progressive Party (D66) scales to the bottom of this dimension. Their placements suggest the vertical axis captures a social liberal–conservative dimension.

In Israel, Labor and Likud are roughly equidistant from the origin and most voters. The horizontal national security axis is anchored by Likud and Yitzhak Shamir on the right and Shimon Peres and Labor on the left. The vertical axis capturing the Israeli secular–nonsecular division is bracketed by the religious Gush Emunim movement at the bottom and Yitzhak Rabin at the top.

The spatial maps are consistent with received theory: the winning or leading party in Canada and France is closer to the center of the electorate than the leading parties in The Netherlands and Israel. No map provides evidence of strong convergent behavior in the sense of all parties locating near the center of the voter distribution. Nonetheless, there are apparent differences between the Israeli and Dutch elections on the one hand, and the French and Canadian elections on the other. More parties are closer to the center of the electorate in the former countries than in the latter. Most important, the winning party and candidate in Canada and France, respectively, is near the origin.

4.2. Measures of spatial centrality

To more formally assess the spatial incentives in each political system, I use a measure of central tendency developed by Kollman et al. (Kollman et al. 1992, 1993). The measure, *centrality*, calculates the relative spatial dispersion of party platforms in each map, and may be used to make comparisons of the relative party and candidate dispersion across maps.

Centrality is calculated for each party or candidate y as the ratio of summed voter quadratic loss functions. The numerator is the sum of the loss functions between voters and the location of the median voter ideal point. The denominator is the sum of loss function between voters and the candidate or party y. Arithmetically, *centrality* equals:

$$C(y)=\frac{\sum_{j=1}^{V} u_{j(\text{median})}}{\sum_{j=1}^{V} u_j(y)} \tag{2}$$

where

$$u_{j(\text{median})} = -\sum_{i=1}^{n} (x_{ij} - y_{j(\text{median})})^2 \tag{3}$$

and

$$u(y) = -\sum_{i=1}^{n} (x_{ij} - y_i)^2 \tag{4}$$

The indices are the same as in Eq. (1). Specifically, x_{ji} is the location of voter j on the ith spatial axis and y_i is party y's location on the same axis. The term $y_{j(\text{median})}$ is the location of the median voter on the jth axis. Simply, *centrality* is the ratio of the sum of squared spatial distances between voters and the median voter, and the sum of squared spatial distances between voters and party or candidate y. For each party or candidate, the value of centrality ranges from 0 to 1.[8] If party y is near the median voter, then centrality(y) is approximately 1. If party y is far from the median voter, then centrality(y) approaches 0. Since centrality is normalized by the distribution of voter ideal points, one can use the measure to compare the relative dispersion across maps.[9]

Table 2 presents the party and candidate spatial locations, corresponding values of centrality and the mean values of centrality. These figures display clear differences in the extent of spatial dispersion between the majoritarian and proportional systems. The mean value of centrality for Israel and The Netherlands is about one-third of that for France and Canada. There is also considerably more variation in centrality for the majoritarian systems than the proportional systems. Further, there are systematic differences in the types of parties returning high and low values of centrality in the majoritarian and proportional systems. In the majoritarian systems, the parties and candidates returning lower values of centrality are ideologically extreme parties and candidates that are not particularly competitive. Examples include French nationalist Jean-Marie le Pen and the Canadian Reform Party. Most importantly, the winning candidates and parties in the majoritarian systems consistently return higher values of centrality. For example, the largest values of centrality in the majoritarian systems include those for the Canadian Liberal Party and Francois Mitterrand. The proportional systems exhibit consistently lower values of centrality and less variation in these scores.[10]

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[8] Technically, *centrality* may exceed 1 unless the spatial location that minimizes average spatial distance across voters corresponds to the location of the median voter. In application, this location is sufficiently close to the location of the median voter that the 0–1 range for centrality is approximated.

[9] Kollman et al. (1998) caution against using *centrality* for comparing spatial dispersion (p. 147), but this is largely in the context of the extremely contrived voter distributions used in their computer simulations. For voter distributions encountered in empirical studies, this measure is appropriate for cross map comparisons (Professor Ken Kollman, Department of Political Science, University of Michigan, November 1998, personal communication).

[10] Because *centrality* is calculated using quadratic loss, it disproportionally penalizes parties and candidates further from the location of the median voter. To assess whether this effect significantly alters the interpretation of the maps, I recalculated *centrality* using absolute distance in the voter utility functions represented by Eqs. (3) and (4). This revealed no substantive differences in interpretation.

Table 2
Axis location and centrality

Party/candidate	Axis 1 location	Axis 2 location	Centrality
Canada 1993			
PCP	42.09	−66.83	0.0983
Liberal	9.74	4.89	0.8658
NDP	−28.60	33.42	0.2544
Reform	62.68	88.13	0.0548
Campbell	31.38	−54.48	0.1470
Chretien	8.05	16.62	0.6713
Manning	58.56	86.21	0.0587
Mulroney	45.22	−84.84	0.0683
McLaugh	−12.54	24.53	0.4648
Mean centrality			**0.2982**
France 1988			
Communist	−17.26	95.55	0.1640
National Front	76.28	69.22	0.1483
RPR	46.61	29.47	0.3821
PS	−14.35	71.58	0.2588
UDF	29.44	33.86	0.4861
Mitterand	−15.04	73.86	0.2466
Chirac	45.78	29.45	0.3884
Barre	26.04	31.30	0.5367
LaJoinie	−11.59	90.82	0.1809
le Pen	75.70	69.00	0.1498
Mean centrality			**0.2942**
Israel 1992			
Labor	−7.53	3.29	0.0743
Likud	3.43	−5.97	0.1027
Gush Emunim	2.76	−8.20	0.0675
Religious	0.57	−9.58	0.0556
Peace Now	−8.56	−3.63	0.0590
Peres	−9.37	1.43	0.0569
Rabin	−4.82	6.91	0.0710
Shamir	3.51	−6.48	0.0908
Mean centrality			**0.0722**
The Netherlands 1994			
PvDA	−51.63	−19.80	0.1085
VVD	51.10	24.43	0.1040
D66	11.57	−53.86	0.1093
CDA	12.07	59.08	0.0929
Lubbers	−3.95	32.08	0.2629
Kok	−45.41	3.56	0.1522
Brinkman	16.98	65.90	0.0744
Bolkestein	51.54	36.81	0.0849
Brouwer	−22.62	−43.03	0.1361
Van Mierlo	5.00	−50.13	0.1279
Woltgens	−22.21	−18.32	0.3102
Mean centrality			**0.1421**

To test directly for differences in central tendency between the majoritarian and proportional systems, I calculated the non-parametric Mann–Whitney–Wilcoxon statistic (Mood et al., 1974; Hogg and Craig, 1995). The test statistic, denoted by Φ, evaluates the null hypothesis that the values of centrality for the majoritarian and proportional systems are drawn from the same statistical distribution. Specifically, if x represents the sample values of centrality calculated from the majoritarian systems and y represents the sample values of centrality calculated from the proportional systems, the Mann–Whitney–Wilcoxon statistic tests the null hypothesis that $F(X)=G(Y)$ where $F(X)$ and $G(Y)$ are the respective distribution functions of the random variables X and Y. Rejection of the null hypothesis provides evidence that there exist systematic differences in the spatial incentives induced by the majoritarian and proportional electoral systems.

An additional statistical assessment of spatial incentives induced by electoral systems is provided by calculating the Mann–Whitney–Wilcoxon statistic to test the null hypothesis that systematic differences exist *within* each electoral system. That is, systematic differences are tested for within the distribution of centrality in the Canadian and French elections on the one hand, and the Israeli and Dutch systems on the other. Failure to reject the null hypothesis in each case supports the argument that the two majoritarian systems induce similar spatial incentives and, likewise, the two proportional systems induce similar spatial incentives.

The test statistic, Φ, is a function of the summed rank values of centrality in each series. Under the null hypothesis, with a large number of observations, the statistic is distributed approximately standard normal. For the small samples used in this study, I calculated the critical test values directly. The test statistic is relatively powerful in small samples, especially when the major differences between the distributions are in central tendency. The empirical distributions indicate significant differences in both central tendency and dispersion, but are most pronounced in the mean values of centrality.

The values of the Mann–Whitney–Wilcoxon statistic strongly support the hypothesis that systematic differences exist in spatial incentives between the majoritarian and the proportional systems. Using the standard normal approximation, the test statistic $\Phi=2.96$, and rejects at the $\alpha=0.01$ level the null hypothesis that the values calculated for majoritarian and proportional systems are drawn from the same statistical distribution. The standard normal approximation and exact probabilities provide strong support for the alternative hypothesis that centrality values are significantly larger in the majoritarian systems than in the proportional systems.

The Mann–Whitney–Wilcoxon statistic for the within system comparisons also reveals the expected patterns. Neither the Canadian–French comparison nor the Dutch–Israeli comparison reject the null hypothesis that the values of centrality for each country are drawn from the same statistical distribution at standard levels of statistical significance ($\alpha=0.10$). The extent of spatial centralization in Canada and France is statistically indistinguishable. The same is true for Israel and The Netherlands. Simply, the statistical tests reveal the spatial distributions of parties and candidates in the majoritarian systems are statistically equivalent, as are the spatial distributions of parties and candidates in the proportional systems.

5. Discussion and conclusion

This study's primary contribution is to provide an explicitly comparative analysis of electoral systems and spatial incentives. While the literature presents spatial analyses of individual and multiple countries, few provide bases for direct comparison by estimating spatial representations using the same methodology across political systems, and none to our knowledge systematically compare the extent of spatial dispersion across electoral systems. The estimated maps and corresponding values of centrality support the expectation that the spatial incentives significantly differ between majoritarian and proportional systems. While none of the four countries exhibit strong centralizing behavior in the sense that most or all parties are located near the position of the median voter, the maps reveal that parties in the majoritarian systems are located significantly closer to the center of the voter distribution than those in proportional systems.

The estimated maps for the majoritarian systems may understate the true extent of centripetal spatial incentives since some of the more extreme candidates and parties may be prominent political symbols, but not serious contenders for governing. This possibility is reflected in the presidential campaign and estimated spatial positions of French Nationalist Jean-Marie le Pen or, to a much lesser extent, the Canadian Reform Party. There is little motivation for corresponding behavior in the proportional Israeli and Dutch elections because even parties that advocate relatively extreme ideological views can still expect to influence government policy due to the low electoral thresholds in these electoral systems.

This study does not seek to evaluate rigorously the policy implications implied by the electoral maps, except to note that the estimated spatial positions of parties and political leaders do not necessarily reflect the moderation or extremism of government policy. Proportional systems may moderate political outcomes through post-election coalition bargaining and government formation. Schofield and coauthors (Laver and Schofield, 1990; Schofield, 1993; Laver and Shepsle, 1996; see also de Swaan, 1973), while investigating models that focus on government formation, argue coalition governments will typically enact moderate policies (cf. Austin-Smith and Banks 1988, 1990). Huber and Powell Jr (1994) provide supporting empirical evidence by reporting an inverse relationship between the extent to which Western European politics exhibit majoritarian characteristics and the average distance between the location of the post-election governments and the location of the median voter. On average, the more proportional the electoral system, the closer the government is to the median voter.

The spatial maps provide only limited evidence on this question. The estimated governing position of the Canadian Liberal Party is near the center of the political space. However, while both the French Socialist Party and President Francois Mitterrand are relatively close to the major node of voters, neither is adjacent to the origin on either dimension. Considering the proportional systems, the averaged position of the post-election Dutch government, consisting of the coalition of the PvDA, VVD and D66 parties, is moderate. This is not true, however, in the Israeli case where Labor was the dominant coalition partner with Meretz (represented by Peace Now)

as the junior partner. The government also included the ultra orthodox Shas Party (represented by Religious Parties).

Finally, this study demonstrates the need for empirical research capable of evaluating the spatial incentives induced by electoral systems. In the context of cross-national research, Hinich and Munger (1998) point to spatial theory's central role in deriving the implications of voting procedures for democratic governance, and call for further empirical studies clearly predicated on the spatial theory of voting. Green and Shapiro (1994) also argue the contributions of empirical spatial theory have not kept pace with theoretical advances. This study provides a modest contribution in this direction, but more significantly demonstrates the need for further empirical analyses of comparative electoral systems.

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